

**REMARKS**

Entry of the foregoing, re-examination and reconsideration of the application, as amended, pursuant to and consistent with 37 C.F.R. § 1.111 and in light of the remarks which follow, is respectfully requested.

Claims 1, 3, 4, 6-9, 11 and 12 are pending in the application and are under consideration, as claims 2, 5 and 10 have been canceled above.

By the above amendments, the specification has been revised to remove minor informalities, as suggested by the Examiner. Claims 1 and 12 have been revised in response to the 35 U.S.C. § 112, second paragraph rejection. Support for these amendments may be found, at least, at pages 7 and 8, lines 12-14 and 6-9, respectively. This rejection is further discussed below. In addition, claims 7 and 8 have been revised to remove minor informalities.

The Examiner has requested that the specification be checked for minor informalities in order to comply with 35 U.S.C. § 112, first paragraph. Per the Examiner's request, Applicants have checked the application and made the above revisions to the specification to remove minor informalities. It is further submitted that the application is in full compliance with 35 U.S.C. § 112, first paragraph.

Claim 7 stands objected to for a minor informality. This objection has been obviated by the above amendment where claim 7 has been revised as suggested by the Examiner.

Claims 1-12 stand rejected under 35 U.S.C. § 112, second paragraph, for allegedly being indefinite for the various reasons cited in the Action. This rejection has been obviated by the above amendments where claims 1 and 12 have been revised to more clearly recite the composition of the photochromic layer, as well as the two transparent synthetic resin layers. In

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addition, claim 8 has been revised to more clearly recite the antioxidant containing at least three hindered phenol groups. The claims, as now presented, are believed to be in full compliance with 35 U.S.C. § 112, second paragraph. Thus, withdrawal of this rejection is in order and it is respectfully requested.

Claims 1, 2, 9, 11 and 12 stand rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by Ormsby et al (U.S. Patent No. 4,889,413). The claims, as amended, cannot be rejected on this basis.

The present invention relates to a transparent synthetic resin laminate with a photochromism property. The invention provides excellent control of the thickness of the photochromatic coated film as well as a high color development speed and a high color disappearance speed.

In accordance with one aspect of the invention, and as set forth in independent claim 1, a transparent synthetic resin laminate with photochromism property is provided. The laminate consists essentially of two transparent synthetic resin layers and a photochromic layer interposed between said two transparent synthetic layers. The transparent synthetic resin in the two transparent synthetic resin layers, is, each the same or different, a polycarbonate resin or a polymethyl methacrylate resin. The photochromic layer is formed by curing a mixture of (1) a polyurethane prepolymer with an isocyanate group on both ends obtained from diisocyanate and polyol, (2) a curing agent comprising a compound with a hydroxyl group on at least both ends obtained from diisocyanate and polyol, and (3) a photochromic organic compound.

Ormsby et al relates to a process for producing polyurethane plastics having photochromic properties from at least one diisocyanate and at least one polyol. See column 12

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and claim 1. In particular, Ormsby et al disclose that polyurethane laminates can be constructed using glass or clear plastic outer layers and used for the production of ophthalmic lenses.

Ormsby et al, however, does not discloses or suggests the species of clear plastic applied to the outer layers. Further, Ormsby et al does not disclose the curing agent of the present invention. In this regard, Ormsby et al only discloses tri-methylol propane as the curing agent utilized. See column 4 (Example 1) at line 26.

By comparison, in the present invention, the transparent synthetic resins in the two transparent outer layers maybe the same or different and each is either polycarbonate resin or a polymethyl methacrylate. Furthermore, the curing agent of the present invention is a particular compound with a hydroxyl group on at least both ends obtained from diisocyanate and polyol which is indispensably applied for the formation of the photochromatic layer. Clearly, Ormsby et al does not discloses or suggests the claimed curing agent.

Further, as shown in the attached Declaration of co-inventor Mr. Kenji Kouno, experiments were carried out on the laminates prepared in accordance with Ormsby et al (i.e., comparative examples) and the present invention. As shown in Mr. Kouno's Declaration, after the completion of the light resistance test, the photochromatic layer corresponding to the laminate of Ormsby et al utilizing a tri-methylol propane as a curing agent peeled off with ease from the polycarbonate film. Thus, clearly the laminates of the comparative examples and those of the present invention are not the same.

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Claims 1, 2 and 11 stand rejected under §102(b) over Hitoshi et al (Japanese Patent Document 4-226750)<sup>1</sup>. This rejection is traversed for the following reasons.

Hitoshi et al is directed to a laminated safety glass with a photochromic light-adjustable function. The laminate has a structure of at least two layers of glass and a thermoplastic polyurethane resin layer.

Although Hitoshi et al teaches a glass layer and a thermoplastic polyurethane layer, Hitoshi et al does not disclose or suggest the application of a polycarbonate resin layer and the polymethyl methacrylate layer of the present invention.

Further, the chain extender of Hitoshi et al of an aliphatic diol having 2 to 10 carbon atoms or diamine utilized for the production of thermoplastic polyurethane is quite different from curing agent of the present invention.

Generally speaking, these are different types of polyurethane resins. For example, different type of polyurethane resins resin include, for example, (1) a one-liquid type composed of a thermosetting polyurethane resin to be heat cured with no curing agent, (2) a two-liquid polyurethane resin type to be prepared from a thermosetting polyurethane prepolymer and a curing agent, and (3) a thermoplastic polyurethane resin type. In the thermoplastic polyurethane resin type, a chain extender is sometimes employed. It is assumed that the chain extender intends to cause chain extension of a thermoplastic polyurethane resin, but also may cause curing to form a net structure to some degree.

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<sup>1</sup> A partial English translation of Hitoshi et al is attached for the Examiner's convenience.

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The polyurethane resin of the present invention corresponds to a polyurethane resin type prepared from a two-liquid composition of a thermosetting polyurethane prepolymer and a curing agent. In contrast, the polyurethane resin of Hitoshi et al corresponds to a thermoplastic polyurethane resin type. Thus, clearly the laminates of Hitoshi et al and the present invention are not the same.

Further, as shown in Mr. Kouno's Declaration, the photochromic layer corresponding to Hitoshi et al had peeled off from the polycarbonate film, as compared with the photochromic layer of the present invention. Accordingly, for all of the foregoing reasons, the claims as now presented, may not be rejected on this basis. Thus, withdrawal of this rejection is respectfully requested.

Claims 1, 2 and 11 also stand rejected under §102(b) over JP '048 (Japanese Patent Document No. 61-148048)<sup>2</sup>. This rejection is traversed for the following reasons.

JP '048 discloses a photochromic laminate including a photochromic layer interposed between transparent material layers, wherein the photochromic layer contains spironaphthooxazine represented by the general formula (I) in a transparent resin. The transparent material layer includes inorganic glass and organic plastic materials. As examples of the organic plastic materials, various materials are exemplified including polycarbonate and polymethylmethacrylate. As examples of the transparent resin to be used in the photochromic layer, various resins are exemplified including polyurethane. However, there is no description, teaching or suggestion that polycarbonate or polymethylmethacrylate are more preferable among

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<sup>2</sup> A partial English translation of JP '048 is attached.

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the examples. As explained above, the present invention corresponds to a two-liquid composition of a thermosetting polyurethane prepolymer and a curing agent. In contrast, JP '048, does not even disclose a curing agent to be used for polyurethane. Thus, the skilled artisan would not be able to "at once envisage" the specific resins within the generic description of JP '048 to be utilized for the particular layers claimed. See, Ex parte A, 17 USPQ2d 1716 (Bd. Pat. App. & Inter. 1990). In fact, the transparent layers in Example 9 and Comparative Example 9 of JP '048 are nylon 6 and polyvinylidene chloride, not polycarbonate or polymethyl methacrylate of the present invention. Accordingly, it cannot be asserted that JP '048 anticipates the present invention.

Further, JP '048 does not disclose or fairly suggest curing agents for the polyurethane, let alone a compound with a hydroxyl group on at least both ends obtained from diisocyanate and polyol, as exemplified in the present invention. In this regard, Example 9 and Comparative Example 9 of JP '048 discloses the use of a thermosetting type polyurethane resin (Dainihon Ink Kogyo, Crisvon NT-1500). However, JP '048 does not disclose a curing agent whatsoever.

The thermosetting polyurethane component of JP '048 (i.e., Crisvon NT-1500) is a one-liquid type thermosetting polyurethane resin containing 50% solid matter and 20% methyl ethyl ketone. As shown in the attached Declaration, this photochromic polyurethane (Crisvon NT-1500) without a curing agent had peeled off from the polycarbonate resin and turbidity of the polycarbonate occurred. Thus, clearly the laminates of the present invention and JP '048 are not the same. Accordingly, withdrawal of this rejection is in order and it is respectfully requested.

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hitoshi et al in view of either Okoroafor et al, Rosthauser et al or Ormsby et al; claim 9 also stands rejected

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under §103(a) as being unpatentable over JP '048 in view of either Okoroafor et al, Rosthauser et al, or Ormsby et al. The claims, as amended, cannot be rejected on these bases.

Hitoshi et al and JP '048 have been discussed in detail above. Okoroafor et al is directed to a polymerizable organic composition comprising at least one capped isocyanate group being substantially free of uncapped polyisocyanate, wherein the capping group is at least one polythiol. See column 12 and claim 1. Further, the capped polyisocyanate is a capped polyisocyanate prepolymer having at least two capped isocyanate groups. See column 5 and claim 12. As described in Okoroafor et al, the capped polyisocyanate is a monomer or prepolymer having terminal and/or pendent capped isocyanate groups. See column 3, lines 1-3.

In contrast, the polyurethane prepolymer of the present invention has an isocyanate group on both ends having no capped groups. Furthermore, Okoroafor et al does not teach or suggest the polycarbonate and polymethylmethacrylate outer layers of the present invention, nor the curing agent claimed. Thus, clearly Okoroafor et al does not cure the deficiencies in Hitoshi et al and JP '048.

Like Okoroafor et al, Rosthauser et al does not make up the deficiencies in Hitoshi et al and JP '048. Rosthauser et al is directed to a thermoplastic photochromic polyurethane. See, column 17, and claim 1. In other words, the polyurethane of Rosthauser et al is a thermoplastic polyurethane resin, and not thermosetting. In addition, Rosthauser et al does not disclose or teach the polycarbonate and polymethylmetacrylate outer layers of the present invention, nor the curing agent claimed. Applicants further note that, a chain extender is utilized in Rosthauser et al. See column 12, and Table 1 in column 15.

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Still, as shown in the attached Declaration, the photochromic layer disclosed in the Examples of Rosthauser et al peeled off from the polycarbonate film. Thus, for the foregoing reasons, even if the skilled artisan were to combine these documents in the manner suggested by the Examiner, he or she would not arrive at the claimed invention. Accordingly, withdrawal of these rejections is respectfully requested.

Claims 1-2, 5, 9 and 11-12 stand rejected under §103(a) as allegedly being unpatentable over Rosthauser et al in view of Ormsby et al; claims 1-5, 9 and 11-12 stand rejected under §103(a) as being unpatentable over Okoroafor et al in view of Ormsby et al; claims 3 and 4 are rejected under §103(a) as being allegedly unpatentable over Rosthauser et al in view of Ormsby et al as applied to claim 1 above, and further in view of Okoroafor et al; claims 7 and 8 stand rejected under §103(a) as being allegedly unpatentable over Okoroafor et al in view of Ormsby et al as applied to claim 1, and further in view of Perrott et al; and claims 7 and 8 stand rejected under §103(a) as being allegedly unpatentable over Rosthauser et al in view of Ormsby et al as applied to claim 1, and further in view of the combined teachings of Okoroafor et al and Perrott et al. These rejections are traversed for the following reasons.

The deficiencies in Hitoshi et al, JP '048, Okoroafor et al and Rosthauser et al have been discussed in detail above. Perrott et al discloses a photochromic coating composition including a photochromic dye and a film forming polymer such as polyurethane and a solvent. See columns 25-26 and claims 12-13. However, Perrott et al does not disclose the type of polyurethane the use of a curing agent, or the polycarbonate and polymethylmetacrylate outer layers of the present invention.



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Toba et al is directed to a process for producing a polymer having a hydroxyl group at both terminals, which includes carrying out a polymerization reaction of vinyl-based monomers. See column 5, lines 38-45, and column 42, (claim 1).

The polymer obtained by the production process of Toba et al is referred to as “polymer A.” See column 5, lines 46-48. The composition containing polymer A and a compound “Z” having two or more functional groups capable of reacting with a hydroxyl group per one molecule is referred to as “composition A.” See, column 13, lines 48-52.

The Examiner states that Toba et al discloses a polyol made from TDI (col. 11, line 64) utilized as a part of a two-component PU adhesive. See column 14, lines 56-63. However, as described above, polymer A is obtained by a polymerization reaction of vinyl-based monomers. In contrast, the curing agent of the present invention is a compound with a hydroxyl group on at least both ends derived from diisocyanate and a polyol. Preferred compound for the diisocyanate and polyol, as recited in present claim 6, are tolylene diisocyanate and polypropylene glycol. Clearly, the combination of polymer A and an isocyanate compound of Toba et al is different from the curing agent of the present invention. Thus, even if the skilled artisan were to combine the disclosures of these documents in the manner suggested by the Examiner, he or she would not arrive at the claimed invention. Withdrawal of these rejections is in order and it is respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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**APPENDIX**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE SPECIFICATION:**

**The specification is changed as follows:**

**At page 1, second full paragraph:**

As conventional optical lenses[, particularly,] such as photochromic lenses, inorganic lenses have generally spread. That is, it was usual to add an inorganic coating layer with photochromism property to a surface of a glass or a curing plastic such as CR-39. Recently, as a lens itself, plastic lenses with high impact resistance have spread. Particularly, in United States of America, polycarbonate lenses have widely spread and demand for a sun glass with impact resistance has suddenly increased because of extensive outdoor activities.

**At pages 2-3, the paragraph bridging pages 2-3:**

Further, Japanese Patent Kokai (Laid-open) No.#61—148048 discloses a photochromic laminate interposed a photochromic layer containing a spironaphth oxazine derivative between transparent material layers. Although the prior art discloses an example in which one liquid type polyurethane resin is contained in a photochromic layer, both a color development speed and a color disappearance speed are low[, ] and [thus] insufficient.

**At pages 5-6, the paragraph bridging pages 5-6:**

The transparent synthetic resin to be used in the present invention is not limited as long as it is a resin with high transparency. It is preferable to use a polycarbonate resin and a polymethylmethacrylate resin. As the combination of two transparent synthetic resins, a

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polycarbonate resin, a polymethylmethacrylate or both thereof is (are) applied to [each] the two transparent synthetic resins. A transparent synthetic resin with a thickness of 50 to 2000  $\mu\text{m}$  is [used] applied. Particularly, when bending [processing] into a lens form is performed, it is preferable to use a synthetic resin sheet with a thickness of 100 to 1000  $\mu\text{m}$ .

**IN THE CLAIMS:**

**Claims 2, 5 and 10 are canceled.**

**The claims are amended as follows:**

1. (Amended) A transparent synthetic resin laminate with photochromism property consisting essentially of two transparent synthetic resin layers and a photochromic layer [formed by curing a mixture of a two liquid polyurethane of a polyurethane prepolymer, and a curing agent and a photochromic organic compound which is interposed between said two transparent synthetic resin layers] interposed between said two transparent synthetic layers, wherein the transparent synthetic resin in said two transparent synthetic resin layers, is, each the same or different, a polycarbonate resin or a polymethyl methacrylate resin and said photochromic layer is formed by curing a mixture of a polyurethane prepolymer with an isocyanate group on both ends obtained from diisocyanate and polyol, a curing agent comprising a compound with a hydroxyl group on at least both ends obtained from diisocyanate and polyol, and a photochromic organic compound.

7. (Amended) The laminate according to claim 1, wherein said [two-liquid polyurethane] mixture contains a tertiary hindered amine light stabilizer.

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8. (Amended) The laminate according to claim 1, wherein said [two-liquid polyurethane] mixture contains a tertiary hindered amine light stabilizer and an antioxidant containing at least three [or above of] hindered phenol groups.

12. (Amended) A process for producing a transparent synthetic resin laminate with photochromism property which comprises:

coating a mixture of a [two-liquid polyurethane of a polyurethane prepolymer and a curing agent,] polyurethane prepolymer with an isocyanate group on both ends obtained from diisocyanate and polyol, a curing agent comprising a compound with a hydroxyl group on at least both ends obtained from diisocyanate and polyol, a photochromic organic compound and a solvent on one side of a transparent synthetic resin sheet of a polycarbonate resin or a polymethyl methacrylate resin,

then, removing the solvent from the mixture to a state not to contain substantially the solvent,

then, adhering another transparent synthetic resin sheet of a polycarbonate resin or a polymethyl methacrylate resin to the coated side of said synthetic resin sheet, and

then, curing the [said] substantially solvent-free mixture [of two-liquid polyurethane,] thereby, forming a photochromic layer.



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

1761 Dec  
11/22/02

Applicant : Chiharu NISHIZAWA, et al.  
Serial No. : 09/980,010  
Filed : November 30, 2001  
For : TRANSPARENT SYNTHETIC RESIN LAMINATE  
WITH PHOTOCHROMISM PROPERTY  
Art Unit : 1711

D E C L A R A T I O N

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Honorable Commissioner of  
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I, Kenji KOUNO, Japanese citizen, residing at c/o  
Mitsubishi Gas Chemical Company Inc., Corporate Research  
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Declare:

That I am an inventor of the above application, and  
familiar with the invention and prosecution history of said  
application ;

I performed the following comparative experiments  
in order to demonstrate that a transmittance, a color  
development speed, a color disappearance speed and a contrast  
life after light resistance test (after exposure for 60 hours to a

sunshine weather meter) of the transparent synthetic resin laminate with photochromism property of the present invention are superior to those of each reference.

① Experiment used the polyurethane and the curing agent (tri-methylol propane) disclosed in Example 1 of Ormsby et al (USP No. 4,889,413) instead of the polyurethane prepolymer and the curing agent to be used in the present invention.

② Experiment used ethylene glycol of an chain extender disclosed in Example 1 of Hitoshi et al (Japanese Patent Kokai No. 61-148048) instead the curing agent of the present invention.

③ Experiment used the thermosetting type polyurethane resin (Crisvon NT-150, one liquid type, manufactured by Dainihon Ink Kogyo k.k., in Japan) disclosed in Example 9 of Japanese Patent Kokai No. 61-148048 instead of the polyurethane prepolymer of the present invention and using no curing agent.

④ Experiment used Polyol E (polypropylene glycol triol, having an OH number of 550 mgKOH/g and a number average molecular weight of 306 g/mol) of an chain extender disclosed in Examples (col. 12 and col. 15, Table 1) of Rosthauser et al (USP No. 6,166,129) instead of the curing agent of the present invention.

#### Experiment

#### Comparative Example 2

The same experiment as in Example 1 of the present invention was performed except that 2% of Photochromic compound 1 and 1% of Additive 1 used in Example 1 of the present invention were dissolved in a solution of 15g of di-cyclohexylmethane diisocyanate diluted with 8.3g of tetrahydrofuran and 0.002% of di-butyl tin dilaurate was added thereto as a catalyst. Then, the solution was mixed with a polyol composition in the weight ratio 1:0.795 wherein the polyol composition comprised 54.5 parts by weight of a polyester diol derived caprolactone (number average molecular weight 450), 32.2 parts by weight of polypropylene glycol (number average molecular weight 200) and 13.3 parts by weight a tri-methylol propane and stirred.

The thickness of the photochromic layer thus obtained was measured. Further, the laminated sheet thus obtained were evaluated.

#### Comparative Example 3

The same experiment as in Example 1 of the present invention was performed except that 3g of ethylene glycol was used instead of 3g of the curing agent of Example 1.

The thickness of the photochromic layer thus obtained was measured. Further, the laminated sheet thus obtained were evaluated.

#### Comparative Example 4



The same experiment as in Example 1 of the present invention was performed except that 2% of Photochromic compound 1 and 1% of Additive 1 used in Example 1 of the present invention were dissolved in a solution in 15g of a thermosetting type polyurethane resin (Crisvon NT-150, one liquid type, solid matter: 50%, toluene: 30%, methyl ethyl ketone: 20%, manufactured by Dainihon Ink Kogyo k.k., in Japan) and no curing agent was used.

The thickness of the photochromic layer thus obtained was measured. Further, the laminated sheet thus obtained were evaluated.

#### Comparative Example 5

The same experiment as in Example 1 of the present invention was performed except that 3g of Polyol E (polypropylene glycol triol having an OH number of 550 mgKOH/g and a number average molecular weight of 306 g/mol was used instead of 3g of the curing agent of Example 1.

The thickness of the photochromic layer thus obtained was measured. Further, the laminated sheet thus obtained were evaluated.

#### Experimental results

The thickness of the photochromic layers and the evaluation results of the laminated sheets were shown in Table 1.

### Conclusion

- (1) In Comparative Example 2, both the color development speed and the color disappearance speed were lower than those of Example 1. Further, after the completion of light resistance test (after exposure for 60 hours to a sunshine weather meter), peeling-off of the photochromic layer from the polycarbonate film occurred. Thus, contrast life could not be determined.
- (2) In Comparative Example 3, after the completion of light resistance test, peeling-off of the photochromic layer from the polycarbonate film occurred. Thus, contrast life could not be determined.
- (3) In Comparative Example 4, after the completion of light resistance test, peeling-off of the photochromic layer from the polycarbonate film occurred. Thus, contrast life could not be determined. Further, white turbidity of the polycarbonate film occurred due to the solvents used in the Crisvon NT-150.
- (4) In Comparative Example 5, after the completion of light-resistance test, peeling-off of the photochromic layer from the polycarbonate film occurred. Thus, contrast life could not be determined.

Table 1

	Thickness of photochromic layer ( $\mu$ m)	Transmittance in maximum absorption wave length			Color development speed ta (sec)	Color disappearance speed tb (sec)	Contrast life
		ultraviolet		in irradiation (%)			
		in non-irradiation (%)					
Example 1	177	83		58	13	13	○
Comp. Ex. 2	180	83		55	40	104	×※1
Comp. Ex. 3	175	84		56	12	12	×※1
Comp. Ex. 4	178	75		50	12	13	×※1
Comp. Ex. 5	175	84		56	12	12	×※1

Note: ※1 Contrast life could not be determined due to occurrence of peeling-off of photochromic layer.

The undersigned declarant declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this day of October 10, 2002

Kenji Kouno

Kenji KOUNO